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Environmental Assessment Review | Examen des évaluations environnementales

GUIDELINES FOR THE PREPARATION

OF AN ENVIRONMENTAL IMPACT STATEMENT

FOR

GULL ISLAND AND MUSKRAT FALLS POWER GENERATION SITES PROJECT

ENVIRONMENTAL ASSESSMENT PANEL

OTTAWA, ONTARIO

August, 1978

Canada

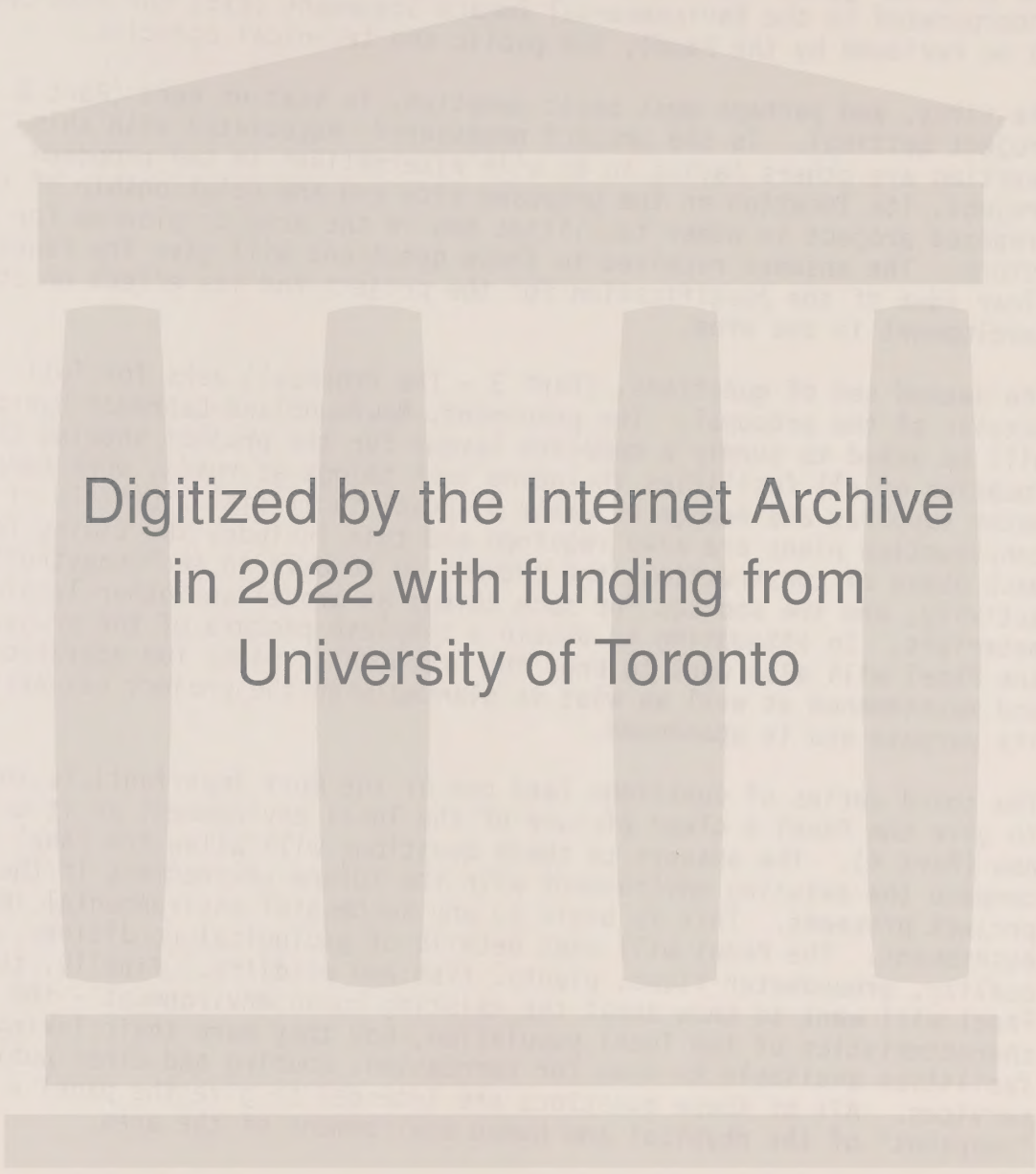
NOTES

The assessment of the potential environmental impact of any project is based on a very straightforward concept. Essentially, it involves obtaining answers to a series of very basic questions and the purpose of the attached guidelines is to ask those questions. The answers will be incorporated in the Environmental Impact Statement (EIS) for this project, to be reviewed by the Panel, the public and technical agencies.

The first, and perhaps most basic question, is that of need (Part 2 - Project Setting). Is the project necessary? Associated with this question are others having to do with alternatives to the proposed project, its location on the proposed site and the relationship of the proposed project to other facilities now in the area or planned for the future. The answers received to these questions will give the Panel a clear idea of the justification for the project and its effect on other development in the area.

The second set of questions, (Part 3 - The Proposal) asks for full details of the proposal. The proponent, Newfoundland-Labrador Hydro, will be asked to supply a complete layout for the project showing the location of all facilities including such things as roads, work camps, water supplies and sewage or waste disposal facilities. Details of the construction plans are also required and this includes the timing for each phase of construction, the methods to be used in each construction activity, and the sources for such things as gravel and other local materials. In attempting to obtain a complete picture of the project, the Panel will also want to know the proponent's plans for operations and maintenance as well as what is planned when the project has served its purpose and is abandoned.

The third series of questions (and one of the most important) is intended to give the Panel a clear picture of the local environment as it exists now (Part 4). The answers to these questions will allow the Panel to compare the existing environment with the future environment if the project proceeds. This is basic to any successful environmental impact assessment. The Panel will want details of geological conditions, water quality, groundwater flows, plants, fish and wildlife. Finally, the Panel will want to know about the existing human environment - the characteristics of the local population, how they earn their living, the facilities available to them for recreation, housing and other public services. All of these questions are intended to give the panel a "snapshot" of the physical and human environment of the area.



In Part 5 of the guidelines, the Panel will ask for the proponent's view of the potential impact of the project on the physical and human environment. The proponent will be asked to identify those aspects of the project which have the potential to disrupt the environment as described in Part 4. This includes both direct and indirect effects. Essentially, what is required of the proponent in this section is to provide estimated impacts on all the environmental characteristics listed in Part 4. This is the true comparison between what is and what will be if the project proceeds.

Having identified the probable impacts in Part 5, the proponent will be asked, in Part 6, to describe the measures he intends to take to counteract or reduce those impacts. If this is not possible in the case of all potential impacts, these must be identified and justified in Part 7.

All of this material is included in the Environmental Impact Statement. For greater detail about what is required in the EIS, please consult the full guidelines attached to this summary.

INTRODUCTION

The Environmental Assessment and Review Policy of the Government of Canada requires that proposed projects initiated or funded by the federal government or with federal lands involved, and which are likely to have significant adverse environmental effects, be submitted to an Environmental Assessment Panel for review prior to the issuance of the necessary authorities to proceed. The Panel, reporting to the Minister of the Environment, reviews an Environmental Impact Statement (EIS) prepared by or for the Proponent of the project, and is submitted by an Initiator department.

These guidelines have been prepared in order that the environmental impact of the proposed Gull Island Hydroelectric project can be determined. The Initiator for this project is the Department of Energy, Mines and Resources and the proponent is Newfoundland-Labrador Hydro.

The Initiator and Proponent are expected to observe the intent rather than the letter of the guidelines and to make every effort to identify and describe all environmental impacts likely to arise from the Project, even for those situations not explicitly identified in these guidelines. Any changes or major deviations from these guidelines are to be approved by the Environmental Assessment Panel prior to implementation.

It should be recognized that the EIS and its review by the public and technical agencies provide the Panel with a pool of information as a basis for its Report.

It is possible that these guidelines include matters which, in the judgement of the proponent, are not relevant or significant to the project or to the study area. This should be so indicated by the proponent in the EIS. The public and technical agencies will have the opportunity to comment upon this judgment. Where the Panel disagrees with the proponent's statements in this regard it may require additional information from the proponent before proceeding with its Report.

GUIDELINES FOR PREPARATION OF AN

ENVIRONMENTAL IMPACT STATEMENT FOR

GULL ISLAND AND MUSKRAT FALLS POWER GENERATION SITES PROJECT

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1. OVERVIEW SUMMARY

The overview summary should be written in such a manner as to allow reviewers to focus immediately on items of concern. It should be written in terms understandable by the general public and in a format that allows it to be extracted directly for publication by the media if this is required, or for use by senior executives requiring a quick appraisal of the situation.

The overview summary should briefly describe the project, the probable significant environmental impacts, the ameliorating and mitigating measures recommended by the Initiator and the significance of the residual unmitigated environmental impacts. Any aspects of the development which might raise public concern should be clearly described. The summary should also identify data gaps or knowledge deficiencies, and the limitations which these deficiencies impose on the Environmental Impact Statement.

2. THE PROJECT SETTING

The details of the project setting shall cover the identification of the proponent (Newfoundland - Labrador Hydro), the Initiating Department of the Federal Government (Energy, Mines and Resources), and the proponent's consultants or agents. In addition, this section shall describe the justification for the project, its alternatives, and details of how this project fits into other general development schemes for the surrounding area.

2.1. Declaration

The Initiator must be identified and take responsibility for statements and judgments in the EIS. The Initiator's agent for carrying out the assessment must be identified, complete with qualifications and references.

2.2. The Need

The Initiator must provide the justification for:

a) the demand for the project;

b) the location of the project at the proposed site; and

c) the timing, with respect to demand, for the project and related projects.

The Initiator must clearly describe the relationship of the proposed project to publicly adopted policy and plans, such as federal, provincial, and regional.

The section should include demand forecast curves, a description of existing and historic demands and the location of the demand.

2.3. Alternatives

The Initiator must provide a description of all practicable alternative processes for generating the energy, and all sites which are alternatives to the site under study. The description should include those alternatives which were rejected and should give sufficient detail to allow the reviewer to comparatively evaluate the costs, benefits and environmental risks of all considerations.

Thus, the alternatives to be considered must include, operational alternatives, the no-development alternative, and the postponement alternative.

2.4. Associated Projects

The Initiator should include in this section, the relationship of the project to other existing or proposed projects (perhaps not controlled directly by the Initiator) or as a component of larger plans or programs. If the project under review will have the effect of accelerating or otherwise stimulating these other projects, then the environmental effects of this alteration should be described.

3. THE PROPOSAL

All alternatives not discarded in 2.3. above must be described under each heading which follows. The factors common to all alternatives may be discussed first, followed by a description of the factors peculiar to individual alternatives.

3.1. General Layout

a) The location of the proposed project in terms of its geographic setting must be clearly defined. At least two location maps must accompany the report:

(i) a small scale location map of the development area relative to readily recognizable geographical features such as major urban centres; and

(ii) a large scale map providing more details of the proposed development area. These maps should show elevation contours. They should also indicate the locations of environmentally sensitive features such as population centres, parks, traplines, native camp sites, game reserves and historic sites.

b) Diagrams and descriptions of the proposed dam facilities should be provided including such items as dykes, spillways, coffer dams, power facilities, intake and discharge channels and structures, proposed fish passage facilities, spawning channels and/or hatcheries.

c) Comparative maps of the proposed reservoir area(s) before and after reservoir filling should be provided. The location(s) of dykes and/or control dams should be noted and where diversions are proposed, maps of the entire length of both the augmented and the diminished stream channels should be provided.

d) Access facilities, construction and permanent roads, bridges, airstrips, wharves, should be located on a map.

e) Town sites and camp sites with associated water supply sources and waste disposal (water, sewer, and solid wastes) areas and fuel storage areas (at town and work sites), should be located on a map.

f) The proposed communication system should be described.

3.2. Construction Details

The following items should be outlined:

a) The time for construction of each major part of the proposal and the intended construction schedule;

b) The construction methods to be used which could have a deleterious effect on the environment such as method of placing and removing coffer dams, extent of dredging, clear-cutting, diversion technique, large earth removal, blasting or seismic disturbance, etc. and possible

alternative construction method(s) to the one(s) proposed which may prove to be less economical but provide less impact;

c) Borrow sites for local construction materials, such as sand, gravel, clay and stone, etc.; their removal and transportation techniques;

d) Estimates of quantities of pollutants (water, land, and air-borne) from the construction camps and the control of these pollutants, estimates should be in mean and maximum terms;

e) A plan for environmental surveillance and monitoring during the construction and an associated plan for contingency response to environmental emergencies. (This plan may require consultation with various services of DFE).

3.3 Operation and Maintenance

The following items should be outlined:

a) The commissioning techniques and their anticipated effects;

b) Quantities of waste materials produced by operation and maintenance programs of this project and their control;

c) Anticipated mode of operation including schedule of discharges and reservoir storage;

d) A plan for environmental surveillance and monitoring during operation.

3.4 Abandonment

The following items should be outlined:

a) The plans for abandonment of all structures, rehabilitation of disturbed areas, etc. contained in the construction, reservoir, or adjacent areas;

b) The plans for abandonment of the structure after useful life, if such plans can reasonably be expected to have been made.

4. DESCRIPTION OF EXISTING ENVIRONMENT AND RESOURCE USE

This section should describe the environment as it exists prior to project development with emphasis being placed on the environmental components and quality characteristics that are of particular importance to the area. Where knowledge gaps exist they must be noted. It should consider both the immediate environment and ancillary areas that may be affected, e.g. improved access to the dam site might result in increased resource exploitation in areas adjacent to the development site. Photographs or illustrations should be included to provide the reviewer with visual orientation of the existing environment. Maps should be used to relate the conditions described to specific areas.

A qualitative and quantitative description of present and potential resource uses should be included.

4.1. Climate and Air Quality

The location of the recording station(s) and the period(s) of operation should be noted.

a) Precipitation (kind, amount, duration, frequency, pH).

b) Winds (velocity, frequency, direction and duration of critical wind speeds).

c) Spring break-up and winter freeze-up dates.

4.2 Terrain

a) Topographic and geologic conditions on site or within the area of influence and possible seismic hazards.

b) Mineral resources or unique geologic/landform features.

c) Bank stability, permafrost, etc.

4.3 Water

The locations of recording stations and the period(s) of operation should be noted.

a) Hydrologic and hydro-geologic conditions of the river basin,

b) Water quality immediately upstream of the proposed project and in the downstream reaches in which impact is to be expected. Downstream effects in terms of disturbance to flow patterns during construction of the dam (reduction of flow, or blockage of flow, duration and period of flow disturbance, time required to fill dam (head pond)).

4.4 Flora

a) Highly productive habitats for fish and wildlife species.

b) Relatively undisturbed or unique vegetation; plant life of special historic or scenic value.

4.5 Fauna

a) Relative seasonal abundance and distribution of the species of fish, amphibians, reptiles, birds and mammals within the area of development.

b) Migration patterns and timing.

c) Rare or endangered species on site or in close proximity to the site.

d) Critical periods within the life cycles of selected species should be described (e.g. nesting period of waterfowl; spawning and nursery periods of fish).

4.6 People

a) Characteristics of the population including life patterns, communities, employment, public facilities and housing.

b) Cultural, social and economic setting of the general area.

c) Historical, archaeological and paleontological sites.

4.7 Land, Water and Resource Use

a) Land quality (land capability).

b) Existing and projected resource use, such as including land and water use for industry, agriculture, forestry, trapping, hunting, fishing and recreation, particularly in the area where growth or population shifts would be induced by the project.

c) Ownership (public, private or special status) of adjacent land.

d) Regional development plans.

5. ENVIRONMENTAL IMPACTS

The discussion must describe and compare the expected positive and negative environmental impacts of the selected alternatives with emphasis on those actions which will cause major environmental disruption. It should describe them in terms of the time frames in

which they will occur -- construction, operation or phasing out. If factual data have not been available during the assessment or those that have been used are of questionable quality, the report must clearly state that the predicted effect(s) was based on subjective judgment and describe existing knowledge gaps.

The impacts should be categorized as direct or indirect -- those that arise directly from the proposed project, such as river bank slumping and those that arise because of secondary activities induced by the project, such as increased resource use due to improved access. They should be identified as long term or short term impacts that enhance, disrupt, impair or destroy existing features, conditions or processes in the natural environment or cause enhancement of, or conflict with, established traditional or historical land and water use and ways of life; or affect the livelihood or health of segments of the human inhabitants; or significantly change the environmental options.

The Environmental Impacts Section should include those actions that will result in irreversible and irretrievable commitments of the resources, including the downstream effect from filling the reservoir.

Detailed attention should be given to:

a) establishment of controlled flow releases in terms of volume and timing;

b) completed diagrams and descriptions of mitigation facilities such as fishways, intake screening devices or compensatory artificial fish production systems;

c) modification to operating schedules to facilitate fish and wildlife production and maintenance.

The format for presentation should follow that of Section 4. Appendix A, "Environmental Components and Functions of the Development", has been developed to assist the Initiator of hydroelectric and other water development projects in identifying the effect of project activities on environmental qualities. The Environmental Impact Statement should include those areas of concern (in the following list) which apply to this development.

5.1 Climate and Air Quality

The type and size of a reservoir can lead to some changes in the local and downstream climate. These changes can eventually result in a modification of local terrestrial eco-systems. Some of the more common changes that might occur are in:

a) precipitation rates; for example the distributions of convective showers and snow flurries may be affected by new reservoirs;

b) the extent of ice cover on waterways and the timing of freeze-up and break-up;

c) fog and ice fog intensities; these may be affected by the project or by related changes in population and land use;

d) evaporation rates, for example when a new reservoir is created;

e) local winds, humidities and air quality may be affected by the project itself or related developments.

5.2 Terrain

The surrounding land could be affected significantly by the creation of a reservoir, construction techniques or improved access. Some of the common environmental qualities that could be affected by any or all of the project functions are:

a) geological stability as affected by the increased loading of reservoir waters;

b) bank stability and erosion with particular attention to the terraces above the dam site, bank stability at the dam site, and at the campsite;

c) the removal of surficial material during construction and operation;

d) unique landforms, historical, archaeological and paleontological sites;

e) mineral resources;

f) detailed description of projected new shoreline of the reservoir;

g) detailed geologic mapping to assess suspected fracture zone adjacent to Gull Island dam site.

5.3 Water

Almost all project activities can have an effect on water -- both ground and surface water.

The more important qualities that might be altered by the activities of the project are:

a) water quality during construction;

b) water quality during operation and maintenance, including potential nitrogen supersaturation problems downstream from dam spillway;

c) drainage patterns and runoff rates;

d) groundwater hydrology;

e) unique physical features, such as rapids or falls;

f) sedimentation rates;

g) special water problems such as permafrost;

h) quantities of water as affected by diversions in or out of a waterway;

i) changes in the occurrence in waterways of ice jams, anchor ice and frazil ice.

j) downstream effects during and after construction of the dam in terms of water quality (changes in water temperature, chemical composition, nutrient levels).

5.4 Flora

Changes in the natural plant communities occur with changes in the area's climate, terrain and hydrological regime. These changes include:

a) species distribution and abundance;

b) the introduction of exotics;

c) plant vigour;

d) the destruction of unique associations;

e) increased exploitation through improved access;

f) the loss or gain of key habitats for fish and wildlife;

g) the consequences of clearing or non-clearing trees from the flooded areas. Upstream effects if flooded area is cut clear in its entirety should be included;

h) logging operations (associated with 5.4(g) with alternatives (and costs).

5.5 Fauna

Included among the faunal changes are not only those easily recognizable in fish, fowl, and wildlife populations but also the micro-organisms that form much of the basic food chain for the higher animals.

The following are some of the important characteristics to be considered:

a) changes in diversity and numbers;

b) the introduction of exotics;

c) the loss or reduction of rare or endangered species;

d) the disruption of food chains;

e) increased exploitation;

f) upstream effects if flooded area is left with standing timber -in relation to future suitability for fisheries and wildlife;

g) detailed inventory of suitable spawning and rearing habitat in reservoirs and tributaries;

h) an inventory, supported by field data collections, of all species of fish occurring in significant numbers during the different seasons of the year in the Churchill River and its major tributaries below Churchill Falls. This inventory

should include the identification of species, information on life histories and residence time, the timing of migratory runs, and the present and potential use of the species by man;

i) baseline information on the physical and chemical limnology of the Churchill River and its major tributaries below Churchill Falls;

j) currently used spawning grounds in the main river and in all significant accessible tributaries below Churchill Falls should be located and quantified in order to assess potential losses;

k) current use of the main river and all significant tributaries below Churchill Falls as nursery and rearing area by all species of fish occurring in significant numbers;

l) as assessment is also needed of the present use by fish of currently inaccessible tributaries in order to provide an estimate of potential use in the future to offset any losses in the main stem;

m) the degree of obstruction to anadromous fish caused by Muskrat Falls and any other falls on the main river and significant tributaries below Churchill Falls should be considered;

n) the present use of Gull Island Rapids as part of the migration route for migratory resident freshwater species should be considered.

5.6. People

The construction and operation of a project can significantly alter the life style of the human population of the surrounding area, particularly in remote areas. The effects could be short term if the project results in induced activity and development. However, long-term and secondary effects should also be examined.

Some of the important changes may be in:

a) population numbers;

b) life style characteristics;

c) employment;

d) established rights.

e) preservation of artifacts

An estimate of the types of people affected and the number involved should be provided. In addition to the above, the EIS should also discuss the social impact of the project, if the project goes ahead, if it does not go ahead, and if it is implemented in an alternative manner. The EIS should consider both positive and negative changes for each group of people affected in terms of the severity of impact.

5.7. Land, Water and Resource Use

A water related project can either expand or contract the land, water and resource use of an area by providing easier access or flooding useful land and resources. The results could be significant to the indigenous population of the area.

Consideration should be given to some of the more important factors such as:

a) present and projected land use;

b) present and projected resource exploitation;

c) transportation;

d) industrial activity;

e) recreational activity;

f) area development plans, municipal, regional, etc.;

g) aesthetics.

5.8. Combined Impacts

Synergism of impacts may create a total effect in excess of each action. This subsection is, therefore, included to assure the reviewer that combination as well as single action impacts are considered. It should provide for an overall view of the project's environmental impacts in which the interrelationship and the interaction of the individual impacts are considered to give a combined impact assessment.

The following should be emphasized (but not to the exclusion of other considerations):

a) new terrestial and aquatic habitats likely to develop in reservoir area;

b) detailed analysis of potential new eco-systems in reservoir and surrounding area;

c) biophysical techniques may be employed in developing the information but the data collected should be used in the EIS as a basis for extrapolation and identification of new habitats which would be considered and assessed;

d) long term downstream impacts of controlled water flow (reduction of floods and etc.) on terrestial and aquatic ecosystems, including estuary and surrounding grasslands, and also including contiguous areas of Lake Melville; maximum flows which can be sustained and tolerated by newly created lowlands should be identified.

6. MITIGATING MEASURES FOR MAJOR IMPACTS

Many of the major impacts of water related developments can be lessened or eliminated by varying construction, design, or operation techniques. In this section, the major impacts described in Section 5 should be listed in point form together with recommended mitigating or remedial measures. Particular attention should be given to significant changes in land and water use patterns, surface and groundwater quality and quantity, and encroachment on wetlands, or fish and wildlife habitat. This land item has special significance when threatened or endangered species may be affected. Original or unique measures to mitigate against adverse environmental impacts should also be included for consideration. The alternatives proposed to render more acceptable any negative social effects should be described.

7. RESIDUAL IMPACTS

Some of the significant impacts of Section 5 will remain unmitigated through lack of technology, incompatibility with the objectives of the project, or a complete lack of the necessary detailed knowledge. These remaining impacts should be listed in this section in point form and reference made to the reason for its unmitigated state. This may serve as a guide to further study of the current project or future projects as deemed necessary, by an Environmental Assessment Panel.

8. ANNEXES

The annexes to the E.I.S. should include:

8.1. an annotated list of references cited - i.e. documentation.

8.2. copies of reports developed from studies associated with the evaluation.

8.3. supplementary pictorial displays.

9. APPENDICES

Appendices to these guidelines are as follows:

A Environmental Components and Functions of the Development.

B Engineering - Environmental Interface for Hydroelectric Developments.

APPENDIX A

ENVIRONMENTAL COMPONENTS

AND

FUNCTIONS OF THE DEVELOPMENT

2. Biological Characteristics

2.1. Flora

Introduction of Exotics
Trees
Shrubs
Herbs
Crops
Microflora
Aquatic Plants
Endangered Species
Barriers
Corridors
Diversity

3. Cultural Characteristics

3.1. Land and Water Use

Wilderness
Wetlands
Forestry
Pasture
Crop Lands
Residential
Commercial
Industrial
Mining
Transportation
Hunting
Fishing
Boating
Swimming
Camping
Picnicking
Resorts

3.2. Aesthetics

Scenic Views
Unique Biophysical Features
Parks and Reserves
Historial, Archaeological and Paleontological Sites
Rare or Unique Ecosystems

3.3. People

Life Style
Employment
Population Density
Health and Safety

II. FUNCTIONS OF THE DEVELOPMENT

1. Construction

Roads, Culverts and Bridges
Airstrips
Wharves
Railroads
Canals
Types of Vehicles
Ground Cover Removal
Blasting and Drilling
Burning
Marsh Fill and Drainage
Construction Camps
Permanent Townsite
Garbage Dumps
Water Supply
Diversions
Coffer Dams
Dredging
Diking
Dam and Generating Facility
Control Dams
Electrical Substation Yard
Intake Structure
Spillway
Surge Tank
Penstock
Tunnels and Underground Structures
Borrow Pits
Spoil Areas
Quarries
Fuel Storage
Spent Lubricants
Empty Fuel Drums
Collecting Sites
Application of Insecticides
Application of Herbicides
Road Applicants
Rip Rap

2. Operation

Landscaping Erosion Control
Reforestation
Reservoir Regulation
Reservoir Filling
River Control and Flow Modification
Road Maintenance

3. Abandonment

Borrow Pits
Spoil Areas
Garbage Dumps
Construction Camps
Structure Abandonment
Access Facilities

APPENDIX B

ENGINEERING - ENVIRONMENTAL INTERFACE

FOR

HYDROELECTRIC DEVELOPMENTS

ENGINEERING-ENVIRONMENTAL INTERFACE FOR HYDROELECTRIC DEVELOPMENTS

DEVELOPMENT STAGE	MILESTONES & MAJOR OUTPUTS	ENGINEERING/ECONOMIC ACTIVITIES	POSSIBLE ENVIRONMENTAL INTERFACE	NOTES
1. Demand	Defines need for new & expanded facilities & services	Monitor existing & historical demand levels Inventory existing facilities & services	Informal contact to discuss the need and possible conservation measures	Early contact allows maximum lead time on Environmental Assessment thinking
2. Concept	Formulate various project options Sites for various alternatives identified	Formulate various possible solutions to existing & forecast capacity demand problems First benefit cost study done.	Informal contact with governmental agencies to ensure alternatives are getting serious consideration	Project not defined Insufficient detail to warrant Environmental Assessment, but informal contact valuable
3. Feasibility	Site Selection	Refine demand forecasts Preliminary planning (rough sizing and functional layout) Cost estimates Financial feasibility	Major inputs to site selection Also inputs to preliminary planning and operational feasibility	Major benefits of Interface occur at this stage. Significant contribution

ENGINEERING-ENVIRONMENTAL INTERFACE FOR HYDROELECTRIC DEVELOPMENTS

DEVELOPMENT STAGE	MILESTONES & MAJOR OUTPUTS	ENGINEERING/ECONOMIC ACTIVITIES	POSSIBLE ENVIRONMENTAL INTERFACE	NOTES
3. (cont'd)		(Cash flow and financing) Economic feasibility (benefit & cost ratio) Operational feasibility site selection	Environmental aspects added to benefit cost Studies (Not quantified)	made before final site selected and while options are still available. Preliminary assessment report prepared at this stage.
4. Planning	Master plan report	Final demand forecasts Final functional layout and facility sizing Cost estimates improved Final financial and economic feasibility studies (if not established in Stage 3)	Continuing liaison valuable in many cases in final functional layout	In some cases stages 3 and 4 are lumped together in which case preliminary assessment report done here.
5. Design	Construction cost estimates	Preliminary engineering design, based on master	Liaison with respect to type and	Definitive assessment

ENGINEERING-ENVIRONMENTAL INTERFACE FOR HYDROELECTRIC DEVELOPMENTS

DEVELOPMENT STAGE	MILESTONES & MAJOR OUTPUTS	ENGINEERING/ECONOMIC ACTIVITIES	POSSIBLE ENVIRONMENTAL INTERFACE	NOTES
5. cont'd	design report construction financing usually arranged by this stage	plan Selection of construction materials & type of construction Preliminary selection of physical components Construction cost estimates	location of construction materials. Modifications to site and master plan, undesirable from engineering viewpoint, may be required.	report prepared here, if required.
6. Documentation (also called detailed design)	Call for tenders	Final selection of physical components Final design Preparation of detailed plans and specifications for construction Final construction cost estimates	Advise suitable modifications to mitigate undesirable impacts	Monitor design changes in the ongoing project, check for changing impacts by prepared for changes
7. Construction	Selection of contractors Construction takes place	Control construction schedule Obtain materials and supplies Build	Liaison re: access to remote sites Monitor cleanup on completion of construction	Witness testing Confirm design requirements are met
8. Operation and Maintenance	Facility produces required goods/services	Little or none except operational changes to optimize output	Monitoring by EPS	
9. Demand	PROCESS CONTINUES TO CYCLE THROUGH STAGES			

The Engineering stages described above are generalized. Flexibility with respect to the Engineering-Environmental Interface may be required for individual development projects (especially in the early years of the Environmental Assessment Program).